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An Experimental Study of Certain Phases of Chronic Backache

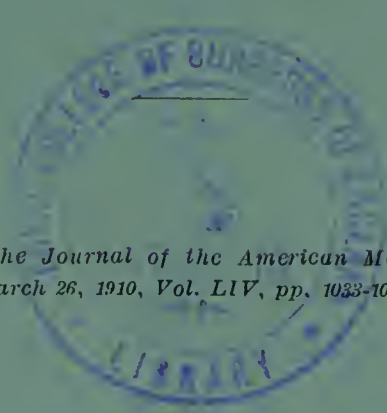
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INVESTIGATION

EDWARD REYNOLDS, M.D.

AND

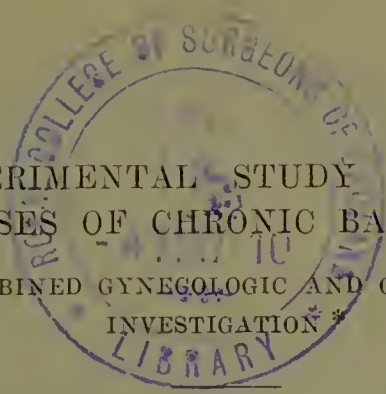
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BOSTON



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CHICAGO



AN EXPERIMENTAL STUDY OF CERTAIN PHASES OF CHRONIC BACKACHE

A COMBINED GYNECOLOGIC AND ORTHOPEDIC
INVESTIGATION*

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DEFINITION OF CLASS OF CASES UNDER INVESTIGATION

For an indefinite time the medical profession has been confronted with a very common and perplexing class of cases, mostly in women, but occasionally in men, in which persistent backache is the chief subjective symptom.

These cases present the following symptomatic picture: The pain, generally dull in character, is as a rule referred to the sacral or lumbar region and is frequently felt in one or both sacro-iliac joints; rarely it is complained of in the dorsal region. It also frequently shoots down one or both legs, in which case it is generally classed as "sciatica" and is aggravated by forward bending or flexion of the thigh with the knee extended. The pain in the back and leg are aggravated by standing, and especially by prolonged standing, such as is involved in the fitting of women's dresses. It is sometimes relieved by the recumbent position, but at times is at its worst when the patient rises in the morning. The pressure of the hand in the small of the back while sitting, or the use of a cushion in the same region in sitting or lying, are instinctive means of relief which every practitioner has seen these patients use. The pain

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is most often aggravated during menstruation and in general is either unilateral or bilateral, but in the latter case on close questioning is usually found to be worse on one side than on the other. Local tenderness may or may not be present. If the back is exposed and the finger-tips are placed over the erector spinæ muscles, perceptible spasm may be excited in these muscles by voluntary forward or lateral bending at the waist, and perfectly normal spinal mobility is unusual in the more marked cases. Bending is frequently better performed to one side than to the other. The nervous element in these cases may be slight, or so severe as to dominate the whole picture.

The condition sometimes originates from accidents, such as falls; it begins at other times as the result of overuse or strain, as in prolonged piano-playing, after heavy lifting, or after surgical operations. At other times it is found without assignable cause. The affection is exceedingly persistent and seldom very severe, and its most striking characteristic feature is the patient's insistence on a habitual pain for which no adequate cause is apparent. A search for that cause was the purpose of this investigation.

PRESENT TERMINOLOGY

The causes of this condition have been variously assigned by specialists and the general practitioner to the pelvic organs, to the muscles and joints, and to the nervous system. The uncertainty concerning its true nature is expressed by the many names applied to the condition, of which the most common are the following:

- Hysterical spine.
- Neurasthenic spine.
- Weak back.
- Uterine backache.
- Irritable spine.
- Chronic lumbago.
- Railroad spine.
- Relaxation of the sacroiliac joints.

Among the laity the condition is often attributed to kidney disease.

Without denying the existence of cases in which this symptom is the result of diverse causes, such as actual uterine, spinal or sacro-iliac disease, we are inclined from the observations and experiments to be described to

regard the term "static backache" as more truly descriptive of the majority of these cases. By which term we mean pain due to back strain incurred by an undue effort to maintain body balance under the conditions of the individual physiology.

ESTABLISHED TREATMENT

If the patient is a woman and any abnormality of her uterine system can be found, it is usually considered adequate reason for immediate treatment by the gynecologist. If some innocuous uterine peculiarity is operated on in order to cure a backache which is dependent on an overstrain of the back muscles, the results are not likely to be gratifying to the patient or to add much to the reputation of the surgeon who performs the operation. So, too, the orthopedic surgeon who devotes months of effort with apparatus and gymnastics to the relief of back strain caused by the faulty posture originated by inflamed pelvic organs is likely also to fail.

Outside of the gynecologic treatment, patients of either sex are treated by jackets, corsets, plaster strapping, splints, pads, springs, belts, massage, vibration, gymnastics, heat, electricity, etc. The application of each one of these measures is empirical and the method of action of each is in general as little understood as the etiology of the condition for which it is used. If, instead of this blind work, a serious attempt is made to investigate the causes of the condition and to study its mechanics, it is possible that much confusion and many failures will be saved.

I. EXPERIMENTAL SECTION

REASON FOR PRESENT INQUIRY

The following experimental study, which has occupied us for the past three and one-half years, was undertaken because of the frequency with which one of us in gynecologic and the other in orthopedic practice met such cases of chronic backache, especially in women, and the study was made a joint one because we concluded that a consideration of the subject from our two different points of view would be more likely to be of use than two pieces of work done by each of us separately. No sooner had we started on our joint investigation, however, than we realized that neither of us had any exact comprehension of the causes or mechanism of the

condition, matters which were evidently essential to any clear comprehension or study of the subject. We therefore turned to a study of the literature of the mechanics of the erect posture and found at that time little but vague statements, founded mostly on accepted authority rather than on observation of the living individual by reliable scientific methods. We were, therefore, obliged to begin our work by formulating for ourselves methods for the study of the mechanics of the maintenance of the upright position, and at the outset it became evident that any such study must start with a determination of the center of gravity of the body, and its relation to the supporting structures, because all lines of strain and all muscular balance depend obviously on such relations, and we desire here to express our indebtedness to Prof. Ira N. Hollis, of Harvard University, for advice generously given us on the mechanical side of our problem.

Our first two years and a half were, therefore, spent in a purely physiologic research, at the end of which time we had perfected an apparatus for determining the center of gravity in the erect living individual.¹ Up to the time of this, our contribution to physiology, there had existed, so far as could be learned from a study of literature, no reliable method of estimating the position of the center of gravity of the body in the upright position. Various loose statements as to its location are given in literature, and there are a few carefully formulated attempts to determine it by a study of the masses of the body post-mortem and their relation to each other, but scarcely any two writers agree as to what the erect normal posture should be.²

1. Reynolds, E., and Lovett, R. W.: Method of Determining the Position of the Center of Gravity in Its Relation to Certain Bony Landmarks in the Erect Position, *Am. Jour. Physiol.*, May 1, 1909.

2. Borellius, J. A.: *De Motu Animalium*, Lugduni Batavorum, 1679.

Braune, W., and Fischer: Ueber den Schwerpunkt des menschlichen Körpers, *Abhandl. d. k. Sachs., Akad. d. Wissensch., Math.-physik. Klasse*, Leipzig, 1889, xv, 7.

Dickinson, R. L.: The Corset; *Questions of Pressure and Displacement*, *New York Med. Jour.*, Nov. 5, 1887.

Duchenne: Etude physiologique sur la courbure lombo-sacrée et de l'inclinaison du bassin pendant la station verticale, *Arch. gen. de méd.*, series 6, viii, 534.

Goldthwaite, J. E.: The Influence of Pelvic Joints on Posture, *Physical Education Rev.* June, 1909.

Goldthwaite: The Relation of Posture to Human Efficiency, *Dec. 9, 1909*.

Gerdy: Détermination des leviers que forment la colonne vertébrale, les fémurs et les tibias dans l'attitude verticale, *Rev. méd.*, 1834, 323.

Horner, F.: Ueber die Krümmung der Wirbelsäule im aufrechten Stehen, *Inaug. Diss. Zurich*, 1854.

The method in previous use had been as follows: A cadaver was dismembered, the center of gravity for each arm and leg, the head and the trunk were separately obtained and, by a formula, the relation of these masses to each other in an ideal erect posture was calculated, and the center of gravity of the whole body in this posture was then located therefrom. From our observations we believe that the position of the center of gravity obtained in this way is misleading and untrustworthy for translation to the living, because the results obtained have failed so markedly to agree with the actual position of the center of gravity in the actual erect posture as obtained by us.

A study of the well-known method of Borelli for determining the center of gravity in the horizontal position suggested to us our method of determining the antero-posterior position of the center of gravity of the body in the standing posture; and the correlation of it to certain bony landmarks was easily added, as will be described.

AUTHORS' METHOD OF DETERMINING THE CENTER OF GRAVITY IN THE ERECT POSITION

On the platform of a dial scale registering up to 100 pounds is placed a sharp edge which supports one end of a flat board (B), the other end of which is supported by a similar sharp edge placed on a rigid block (C). The distance between the edges is 508 mm. (20 inches). A short distance behind the rigid block is placed an upright post (E) with a horizontal sliding arm (D, shown in section only), which furnishes a plane of reference from which the antero-posterior position of

Kellogg, J. H.: *Experimental Researches: Relation of Dress to Pelvic Diseases of Women*, Tr. Mich. State Med. Soc., 1888.

Kellogg, J. H.: *The Relation of Static Disturbances of the Abdominal Viscera to Displacements of the Pelvic Organs*, Proc. Internat. Periodical Cong. Gynec. and Obst., 1892.

Kohlrausch, E.: *Physik des Turnens* Hof, 1887, p. 17.

Lane, W. Arbuthnot: *Lancet*, London, Nov. 13, 1909.

Meyer, G. H.: *Die Statik und Mechanik des menschlichen Knochengerüsts*, Leipsic, 1873.

Mosher, Ella M.: *The Influence of Habitual Posture on the Symmetry and Health of the Body*, Brooklyn Med. Jour., July, 1892.

Mosso: *Application de la balance à l'étude de la circulation chez l'homme*, Arch. ital. de biol., 1884, v. 131.

Parow, W.: *Studien über die physikalischen Bedingungen der aufrechten Stellung und der normalen Krümmungen der Wirbelsäule*, Virchows Arch. f. path. Anat., 1864, xxxi, 74.

Schmidt: *Unsere Körper*, 1903, p. 63.

Staffel, F. M.: *Die menschlichen Haltungstypen und ihre Beziehung zu den Rückengrattsverkrümmungen*, Wiesbaden, 1889.

Taylor, C. Fayette: *Spinal Irritation, or the Causes of Backache among American Women*, New York, William Wood and Co., 1870; Tr. Med. Soc. New York, 1864.

Weber, M. and E.: *Mechanik der menschlichen Werkzeuge*, Göttingen, 1836.

each of the important landmarks of the body can be determined by measuring their horizontal distance from this sliding arm.

The determination of the antero-posterior position of the center of gravity in the standing subject is made as follows:

The subject is weighted on an ordinary set of scales. He is then placed on the balance plane (B) at a known point facing the scales. (The exact point is unimportant, but after some experimentation we selected as most convenient that in which the heels are situated at one-fourth the length of the plane from the posterior sharp edge.) A removable ledge (F) against which the heels are placed is provided here.

Since the balance plane on which the subject stands acts as a lever, in which the weight is borne between the fulcrum (the posterior sharp edge) and the supporting force (the spring which governs the scales), it is evident that the weight recorded on the dial (the balanced weight) will bear to the total weight the same proportion as that which obtains between the total length of the balance plane and the distance between the perpendicular dropped from the patient's center of gravity and the posterior end of the plane. That is: As the total weight is to the balanced weight, so is the total length of the board to the horizontal distance of the center of gravity of the patient from the posterior sharp edge (the fulcrum), or, to illustrate by a specific instance: The subject's total weight is 140 pounds; when placed on the balance plane his weight is 50 pounds, and the total length of the board is 20 inches.

The formula reads then:

$$\frac{140}{50} = \frac{20}{x}$$

This is then worked out as follows:

$$\begin{array}{r} 140)1000(7.1 \\ \underline{980} \\ 200 \end{array}$$

The center of gravity of the subject then lies perpendicularly above a point 7.1 inches forward from the posterior sharp edge.

After the determination of the position of the center of gravity, which should occupy on an average one or two minutes, the position of the following points which have been marked on the skin are measured and recorded.

1. The position of the back edge of the malleolus.³
2. The position of the back of the head of the fibula.
3. The position of the middle of the trochanter.
4. The position of the posterior part of the spine of the fifth lumbar vertebra.

3. In this and the following determinations the horizontal difference is obtained by a footrule, one end of which is placed against the marked point, while the body of the rule is held by the thumb against the upper surface of the sliding arm. Since this surface (and therefore necessarily the rule) is horizontal, the height of the point observed may be read at the same time, from a graduated scale which is marked on the upright post.

5. The position of the posterior part of the spine of the seventh cervical vertebra.

All these points are taken under the usual conventions of somatologic measurements on the living.

The measurements having been recorded, are then easily translated into graphic form by the reproduction of the observed measurements on a sheet of paper, of which the bottom represents the balance plane, and the edge of the paper the posterior plane of measurement.

These five comprise all the exact measurements which we have taken, but since the value of their graphic representation is considerably enhanced by its combination with some sort of representation of the body profile of the individual, we have completed the examination by the use of a device which obtains this with fair accuracy and which is illustrated in Fig. 2.

A series of horizontal metal arms, tipped with celluloid, slide easily through holes in the vertical wooden arm. These metal arms are shaken out to their full length, and their ends pushed rapidly and lightly against the subject's back in the median line, the point of the uppermost horizontal arm being applied to the seventh cervical vertebra. In the construction of the graphic record (Fig. 4), the position of this profile is known by its relation to the seventh cervical and fifth lumbar vertebrae; that is, these points are marked on the paper from the measurements taken, and the end of the uppermost arm of the profile instrument is laid against the mark which represents the seventh cervical, while a lower point is in contact with the mark representing the fifth lumbar vertebra. The curve is then traced on the paper containing the other measurements from the ends of the pins throughout its length.

The body curve of the ventral surface is obtained in the same way. The uppermost arm of the profile instrument is applied to the anterior surface of the neck at the level of the seventh cervical vertebra. The position of this curve on the chart is ascertained by using as points of reference the horizontal distances between the posterior parts of the seventh cervical and fifth lumbar vertebrae and the points horizontally opposite on the ventral surface, measured on the subject by a pelvimeter or other calipers.

It would be very desirable that this graphic record should be completed in every instance by a representation of the inclination of the brim of the pelvis, which would, of course, include its relation to the trochanter, but after much experimentation we have been unable to measure with accuracy the inclination of the pelvic brim in the living subject.

The use of the profile curves in the graphic representation involves the disadvantage that the chart must be drawn life-size, but it can be reduced later by a pantograph to any desired size. The change effected in an individual by treatment or apparatus may be most convincingly displayed by the repro-

duction of its record on the same chart, as in the figures shown in the clinical section later.

The sources of error incident to the method have been carefully studied. They are swaying of the subject, errors in measurement from the vertical plane, distortion of attitude during observation, inaccuracy in locating on the skin the bony landmarks selected, varying position of the feet, horizontal rotation of the pelvis and psychical influences. These errors and their prevention are dealt with at some length in the original description of the method, and therefore need not be repeated here.

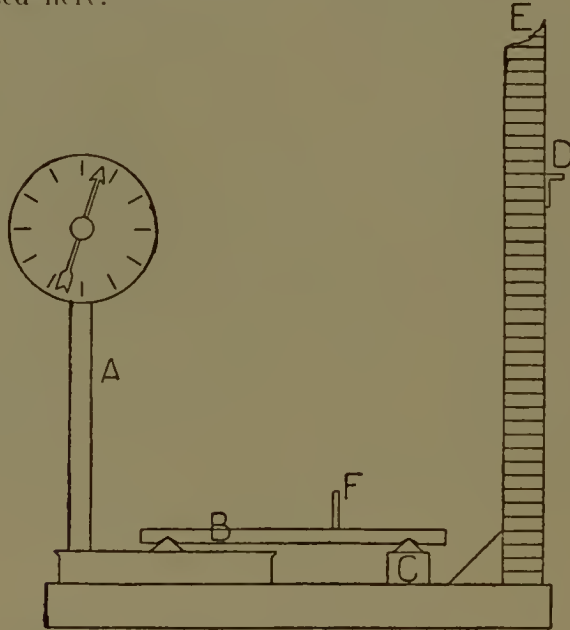


Fig. 1.—Diagram of the apparatus for estimating the center of gravity: A, scale. B, balance plane on which patient stands facing A. C, block supporting triangular edge. D, movable horizontal arm on upright for obtaining horizontal distances. E, vertical upright for standard plane. F, ledge against which heels are placed. (American Journal of Physiology.)

OTHER METHODS OF STUDY USED

At the beginning of our study we experimented with various methods which proved to be worthless for exact use. These were shadowgraphs, observations with plumb lines, study of the model standing on a glass plate by means of a reflected image in a mirror placed underneath and measurements from an upright without knowing the center of gravity. Photographs were largely used, at first without success, but later, by making two exposures on the same plate with the greatest care to prevent jar of the camera, two positions of the model could be recorded with accuracy, but any such composite photograph which showed any duplication of outline of the

feet was rejected. Such photographs were mainly used in checking the accuracy of our results from our final apparatus.

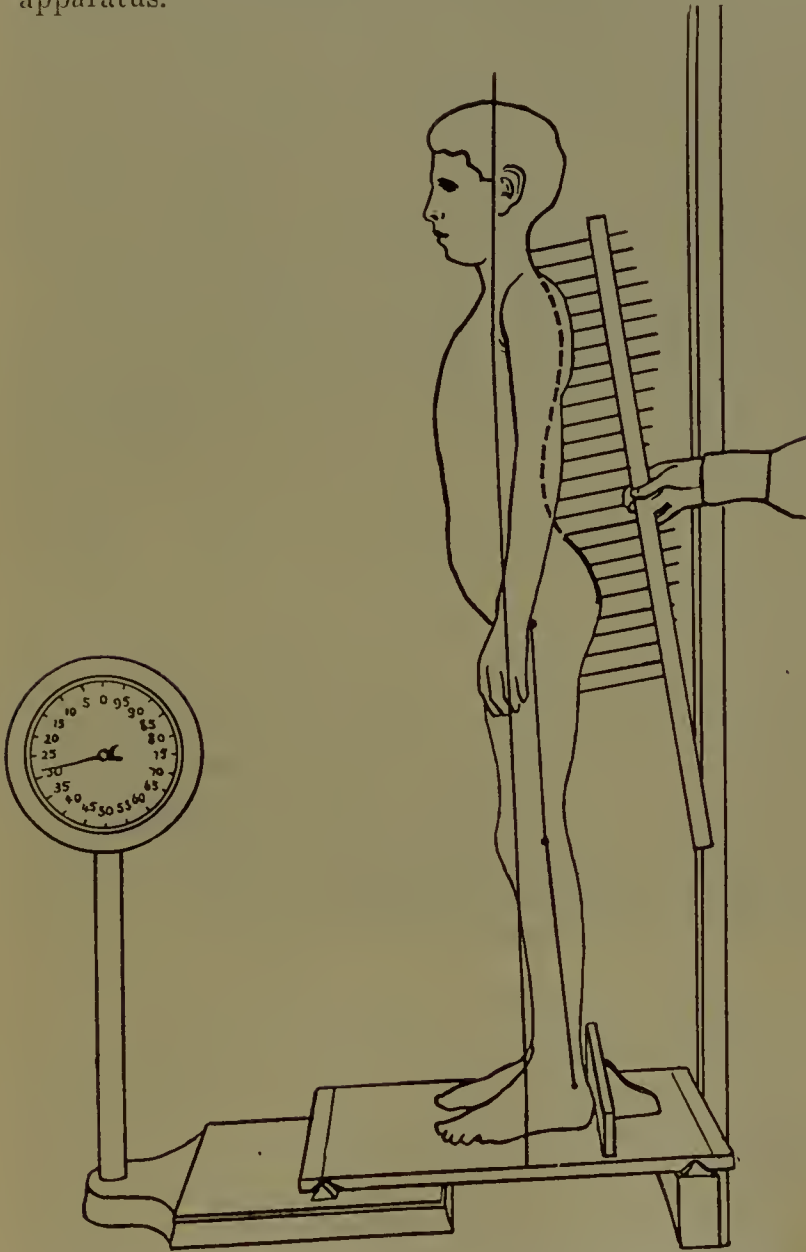


Fig. 2.—Apparatus in use. The lines drawn represent the lines shown in the record tracings. The long line running vertically is the perpendicular of the center of gravity.

Out of several hundred observations made mainly by the apparatus described, we finally selected two hundred as reliable for study, which form the basis of our present communication.

MATERIAL STUDIED

The study was made for the most part on female nude professional artists' models courteously sent to us by the School of the Boston Museum of Fine Arts. In the three and a half years some six of these were under observation, our study of one model at first lasting for months, while, toward the end, two or three were under observation during a fortnight. We selected female rather than male models because they were more easily obtained and more reliable, also because the condition under study occurs much more frequently in women.

Professional models, although clearly the only available material for our purpose, present certain disadvantages which we recognized. They are necessarily of stable types of figures, as otherwise the long-continued assumption of one position necessitated by their occupation would be intolerable, whereas we should have preferred to study women of the unstable types of figure. Another obstacle lay in their desire to help us, and we had carefully to conceal from them the purpose of our inquiry. Another difficulty lay in their ability and readiness to assume fixed unnatural positions, which in posing for artists they are, of course, compelled to do. We therefore supplemented the observations on these by such observations on patients as could be made without undue exposure, and a few such on normal persons, which have also been utilized in formulating our conclusions. These observations were then studied in detail, carefully correlated and analyzed.

DEFINITION OF FIELD OF EXPERIMENTAL STUDY

A consideration of the results of our physiologic study led us to the conclusion that antero-posterior balance in the upright position is maintained by moderate tonicity of the posterior musculature exerted against a slightly anterior position of the center of gravity. Reasoning from this led us to further experiments and observations, to be presently detailed, which seem to us to show that an important element in all static backache is to be found in back-strain, and that to assume relaxation of the sacro-iliac joints to account for the symptoms found is neither necessary nor wholly satisfactory. As soon, however, as we began to plan a series of observations relating to the question of balance, it became evident that the field was so large that we could hope to cover

for the present only some one small phase of the subject, and after a survey of the whole field of inquiry opened by our physiologic research we decided to limit ourselves for this first paper to a study of the very suggestive question of why such backache was in our clinical experience frequently improved or relieved by the use of corsets or high-heeled shoes.

No one realizes more fully than ourselves how very small a portion of the whole field we have here covered, and our present contribution is regarded by us rather as a report of progress, possibly of therapeutic value, than as a final settlement of even the management of static backache. It is our intention to pursue the lines of investigation already undertaken further as opportunity may permit.⁴

PRELIMINARY CONSIDERATION OF PHYSICS RELATING TO BALANCE

For the proper comprehension of the practical application of our experimental work to clinical conditions, it is necessary at this place to introduce certain elementary points in mechanics which are familiar to every one, for the preliminary problem under consideration resolves itself into an analysis of the mechanism of the standing position.

These points are the following:

1. The base of support of the upright human figure consists of a trapezoid formed by the outer borders of the feet and lines connecting the back of the heels and the front of the toes.

2. The center of support lies perpendicularly under the center of gravity and must always lie within this trapezoid.

4. Other lines of investigation at once suggest themselves as likely to prove of value, especially from the point of view of the orthopedic surgeon. (a) The establishment of a "normal" for the standing position and the formulation of the normal position of the center of gravity is possible with a sufficient number of observations. (b) The relation of the line of weight to the foot may be of much importance. It is obvious that the further forward this line falls the greater will be the strain on the tissues supporting the arch. It may in the future aid in the diagnosis and treatment of static disorders of the feet. (c) The attitude of round shoulders is a vicious position of the entire body and not of the shoulders alone, and its treatment by gymnastics would be made more exact and efficient if the attitude were analyzed. (d) Some incidental experiments showed that the effect of corrective gymnastics must be studied by some more exact apparatus than the eye if they are to be correctly and efficiently prescribed. (e) The static conditions evidently underlying the postures of the various abdominal viscera form a most promising field of study.

3. For the purpose of studying the mechanism by which any weight is borne by a solid body in unstable equilibrium, the entire weight may be regarded as concentrated in the center of gravity, and the determination of the relation between the center of gravity and the bearing points determines the lines of stress.

Our observations show that in the erect position the center of gravity of the body lies in front of the ankle-joints, which are held from dorsal flexion in this position by the gastrocnemius muscles. The center of gravity lies also in front of the knees, which are similarly held in position by the hamstring and quadriceps extensor muscles. The center of gravity lies also anterior to the sacro-iliac joints and most of the vertebral joints. The position of the acetabula cannot be determined in the erect position in the living individual because we have no means of locating them from any available landmarks. If we were able to determine the position of the acetabula in the antero-posterior plane it would be possible to state definitely, from the relation of the center of gravity to them, whether the trunk in the erect position would tend to fall forward or backward at their level. But from the impossibility of obtaining definite data on this point we are obliged to resort to another line of observations to determine this matter.

It has been shown by many experiments that when the cadaver is stood erect and the legs and ankles are fixed (to prevent the cadaver from collapsing on the ground), the trunk falls forward from the hips. In the erect position then the trunk is held extended on the legs by the combined and continued action of the posterior musculature, the chief factors here being the hamstrings, the glutei and the erector spinæ muscles.

If, however, for any reason the center of gravity becomes displaced forward, the strain on the posterior musculature necessarily becomes increased throughout, because the vertical stress at each level is determined by the horizontal distance of that point from a perpendicular dropped from the center of gravity, and, if this moves forward, the strain increases in proportion to the increased horizontal distances. So, too, other things being equal, the points farthest away from this perpendicular suffer the greatest stress.

Having presented these preliminary considerations in mechanics, we come next to the report of our experimental observations on the disturbances of balance.

THE EFFECTS OF CORSETS ON BALANCE

Throughout our remarks on this subject, we desire that it should be remembered that our experimental studies were concerned only with balance and the modifications produced on balance by corsets and high-heeled shoes, and that the other effects of these are not discussed.

In our experimental work it early became apparent that the assumption of any enforced position for even the short time involved in an observation left behind it an alteration of the normal, or unrestrained position which persisted for a number of minutes; also that mere maintenance of the standing position resulted in the appearance, after a surprisingly short but variable time, of a modification of the normal which we designated as a "fatigue position."

For these reasons it was necessary in our corset work to take a fresh observation of the normal attitude before each corset observation, to insist that each corset observation should be followed by at least fifteen minutes' complete muscular relaxation in a recumbent posture, and to limit the number of corset observations in any one sitting to two at most.

In their effects on the antero-posterior position of the body, corsets may be divided into three classes and each class must be studied separately if clear results are to be obtained. After much unsuccessful search for a satisfactory nomenclature for these three classes we have adopted the brief and comprehensible, though somewhat unscientific terms: the neutral, the bad, and the good corset.

A. Neutral Corsets

The indifferent or neutral class includes the great majority of all corsets worn by women, but it must be remembered of this statement that it applies only to the effects of corsets on balance, posture and static backache. Many of the posturally indifferent corsets may be harmful in other ways. Few of them are beneficial. At the present time practically all ready-made corsets belong to the posturally indifferent class. Indeed, we found it necessary to have good and bad corsets specially made for each of the models with whom we experimented. Until we did this, our results were confusing, but after this precaution was taken the results of observations on

all forms of corset became uniform, consistent, and sufficiently evident to permit of clear record and definite deductions. Neutral corsets produced no appreciable effect on body balance.

B. Bad Corsets

We use the term "bad corset" to designate that whole class of corsets the use of which we have learned to associate clinically, and to some extent experimentally, with the existence and production of static backache. All corsets of this class have definite common characteristics. All produce the same effect on posture when submitted to exact observation, varying only in the degree of their results. All tend to increase or produce static backache if persistently worn.

The common characteristics of this class of (bad) corsets are as follows: 1. They are long behind (especially



Fig. 3.—Outline drawing of bad corset applied to a model.

at the top) and short in front (especially at the bottom). 2. They are cut to exert their greatest pressure at the waist and at the top and bottom are capable of exerting pressure only against the wearer's back. 3. They have strongly marked sacral curves, but are otherwise straight in the back, and are highly incurved at the waist in front.

Figure 3 is an outline of a representative specimen of the bad corset made from life by a very competent artist. The bad corsets uniformly moved the center of gravity back and effected an important alteration of posture. To the unaided eye this usually appeared as a simple movement of the shoulders forward, but this effect, though very constant, was in fact an illusion. When their action was measured and recorded it proved that

they really threw the shoulders slightly backward, but always much less than the hips, which were thrown far behind the normal, thus inclining the line of the back forward and giving the illusion of forward shoulders.⁵

Figure 4 and Figure 5 show the effect of the bad corset.⁶



Fig. 4.



Fig. 5.

Fig. 4.—Position induced by bad corset in dotted outline; normal in solid line. In this instance the shoulders are thrown back of the normal a little, but not so much as the hips. On this and all following records, the solid vertical indicates the original position of the centre of gravity, the dotted vertical the induced position.

Fig. 5.—Position induced by bad corset in dotted outline; normal in solid line. In this instance the shoulders are thrown forward of the normal and the hips back.

C. Good Corsets

The forms which we class together as the good corset have equally definite common characteristics and effects

5. In a few instances, the shoulders were unmoved or thrown very slightly forward, but always with strong backward displacement of the hips.

6. The bad effect of a corset is not necessarily dependent on stiffness and we have seen the posture described as characteristic of bad corsets induced by badly cut "hygienic" waists.

on posture. They are all in greater or less degree beneficial to those who suffer from static backache.

The common characteristics of all the forms which we class as good corsets are (1) that they are short behind (especially at the top) and relatively long in front (especially at the bottom); (2) they fit the wearer tightly around the pelvis (especially in the space between the iliac crests and the trochanters) and decrease regularly in pressure to their upper edge where they are very



Fig. 6.



Fig. 7.

Fig. 6.—Outline drawing of good corset applied to a model.

Fig. 7.—Position induced by good corsets in dotted outline. Normal in solid line. The apparent flattening of the lumbar curve in the dotted line is due to the bulging of the soft tissues through the open space at the back of the corset.

loose (especially behind); (3) they are considerably incurved at the waist line at the back and sides, but show no waist curve in front. Figure 6 is a life sketch of such a corset. The good corsets invariably moved the center of gravity back, and in all our experiments they threw the shoulders back of the normal, but under their

effect the hips never moved further backward than did the shoulders and sometimes less. Figure 7 shows the actual effects of the good corsets as recorded.

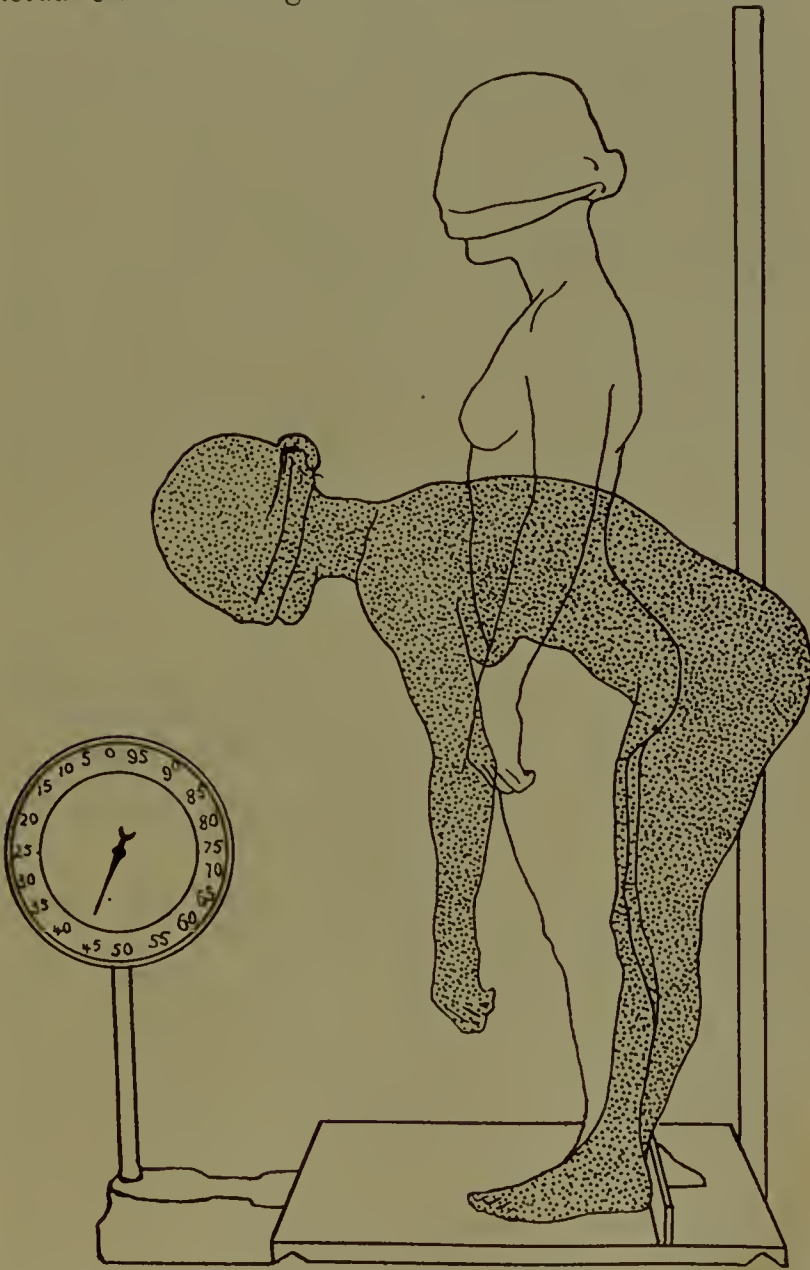


Fig. 8.—Drawing from composite photograph of model in two positions. The center of gravity is not changed in its relation to the feet.

It will be seen that, though both the bad and good forms of corset move the center of gravity backward in its relation to the base of support (the feet), they affect

its relation to the more important bearing points of the body in directly opposite ways, a fact which explains their bad and good effects on back-strain and static backache.

In connection with the effect of the bad corset Figure 8 possesses illustrative interest. This is an accurate outline reproduction of a composite photograph. The model was first told to stand at ease on the balance plane, then to bend forward, and exposures were made of each position on the same plate. The dial of the scale was included in the plate and was found to rest at the same point in both attitudes. The model (who was entirely ignorant of the purpose of the experiment) had instinctively preserved her normal balance, and the relation of the center of gravity to the base of support was unaltered, but its relation to back-strain is seen at a glance to have been utterly different. The stippled position in Figure 8 is, in fact, only an exaggeration of the position induced by bad corsets (compare Fig. 5) as contrasted with the normal, the inclined position of the back subjecting the posterior musculature to increased strain in the dorsal and gluteal regions. No one will doubt that the erect position is one of comparative ease to the posterior musculature, nor that the forward bent position would produce backache if long persisted in.

SELECTION AND MANUFACTURE OF PROPER THERAPEUTIC CORSETS

The recommendation of any specific make of corsets is impossible, even if for no other reason, because there is no make of corsets appropriate to all figures; and there is no make of corsets which remains stable under the changing fashions. There have been times in the past when most of the ready-made corsets belonged distinctly to the bad type. There have been periods in the past when the ready-made corset frequently tended toward the good effect. At the present time, as has been said, most ready-made corsets are inefficient or neutral. A ready-made corset of more or less neutral type can often be so altered by taking up its seams that it produces a fairly good effect, and this can be increased when necessary by the use of a Cook's back splint,⁷ but the manu-

7. A leather support reinforced by light steels bent to fit the back and support the lumbar curve where the corset lacings fail to give the support afforded by the rest of the corset.

facture of a good corset by a skilful corsetière to fit the individual wearer is preferable when practicable.

In the production of the desired effect which should be produced by a "good" corset three points are important: 1. It is essential that the more important seams run diagonally forward and downward in order to secure the proper lines of strain in the cloth. 2. The bones which serve to keep the corset from wrinkling should run in such directions as not to interfere with these strains. 3. The patient should be taught to apply it properly after it has been properly made. These points seem to us so important that they are presented somewhat in detail.

1. In having corsets made for patients the easiest method of obtaining therapeutic results is to have the corset brought to the office after it has been cut and stitched together, but before it has been boned. It should then be somewhat large for the patient, and, after being placed on her, should be made to fit her by pinching up the seams one by one and securing them with pins. In Figure 6 the seams which are especially likely to need tightening in this way are marked with a broken line. The corset when completed should fit very tightly in the space between the trochanters and the iliac crests. This anchors the corset and in many figures prevents its riding up without the use of the objectionable front garter. It should merely fit the patient over the iliac crests and immediately above them, as tightness at this point is uncomfortable and makes the corset ride up. In the back it should fit the hollow of the waist snugly, being hollowed in at the back, but not at the front, and above the waist it should be left as loose as the patient will wear it. In the front it should be straight, without constriction at the waist.

2. The anterior bones should run from above downward and strongly forward.

3. To be properly applied a corset must be laced in three sections, sacral, lumbar, and dorsal. Before it is put on, all the lacings must be widely loosened. The corset must then be settled into place as low as it can be worn, and clasped. The patient should then pass the hand inside it and lift the abdomen into it, settling the front of the corset as low as possible. The lumbar lacing should be pulled comfortably snug. The sacral lacing should then be made as tight as can be borne, and if the

corset is so made as to spare the iliac crests, and properly cut out for the thighs in front, very tight lacing around the solid pelvis is comfortable to the patient. The dorsal lacing should be left as loose as is comfortable.

The clinical tests of the completed corset are that it should be comfortable to the wearer and that it should produce to the eye of the observer the effect illustrated in Figure 6.

THE EFFECT ON BALANCE OF HIGH-HEELED SHOES

The question of body balance as affected by shoes of different kinds has been ably discussed by Cook of Hartford, and our results by measurement correspond closely to those reached clinically by him.⁸

In speaking of high-heeled shoes, it should again be particularly noted that we are speaking only of the effect of such shoes on balance and not of their effect on the foot. Our observations dealt with the effect on balance of shoes with heels varying from $1\frac{1}{2}$ to $2\frac{1}{4}$ inches in height.

Preliminary experiments with composite photographs and the balance apparatus led us to the belief that raising the heel of the unshod foot by means of a book placed underneath tipped the body forward, and that compressing the front of the bare foot by a bandage without raising the heel tipped the body balance back, and we inferred that the effect of the high-heeled shoe was merely the resultant of these two opposed elements. But with the perfection of our apparatus we found that neither of these two component effects was constant, whereas the effect of the high-heeled shoe was constant. After a long series of experiments it became evident that high-heeled shoes tip the body back as a whole without making any appreciable change in the lumbar curve. Figure 9 is an instance of these records. There was but one exception to this effect in our observations on high-heeled shoes. This was in a rather degenerate type of girl whose center of gravity was naturally abnormally far back, and it is probable that her inability to tip further back without falling, forced her to compensate by forward muscular effort against the shoes. This was, at all events, the only exception among many observations.

8. Cook, Ansel G.: The Question of Balance, *Am. Jour. Orthop. Surg.*, July, 1907, and May, 1909.

One possible source of experimental error must be mentioned, for the sake of possible future observers, in connection with this conclusion that the body is tipped back by high-heeled shoes. In overlaying the tracings for comparison the malleoli must correspond rather than the toes or heels. Without this precaution the mechanical distortion due to the oblique position of the foot in high-heeled shoes would lead to evident error.

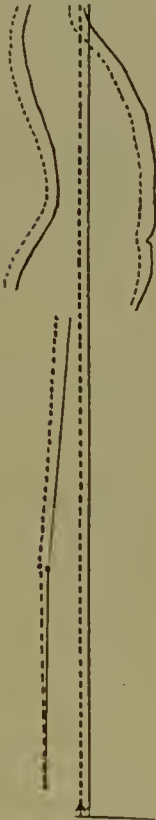


Fig. 9.



Fig. 10.



Fig. 11.

Fig. 9.—Record of the normal position and that induced by high-heeled shoes, the normal in solid line, the induced position in dotted line.

Fig. 10.—Record of normal position in solid line, corset position in dotted line and position of shoes and corsets in black line broken at longer intervals.

Fig. 11.—Record of Patient 4, whose backache was relieved by corset and Cook back splint. Original position in solid line; position of relief in dotted line.

THE EFFECT ON BALANCE OF HIGH-HEELED SHOES AND CORSETS COMBINED

Our observations on the combined effect of high-heeled shoes and corsets opened up a very complicated question that we have not yet been able to solve satisfac-

torily, although it is a more important question clinically than the others, because the combination of high-heeled shoes and corsets is what one meets clinically. In all of our experiments, moreover, we found that models in corsets, and most markedly in bad corsets, were much more comfortable standing in high-heeled shoes than without them—a fact confirmed by clinical experience. In our work on this point each observation was taken of the model without shoes or corsets, then with corsets of one of the various types, and then with both the corsets and shoes. The three tracings were then overlaid for study. The mechanical complications involved were so many that at present we are not prepared to make a more definite statement than that the use of high-heeled shoes seems to modify, toward the individual's normal, the position induced by corsets and particularly the position induced by bad corsets, already described. Figure 10 shows a record of this combination.

Finally, in this connection, we would protest against the indiscriminate advice so generally given to patients with backache to avoid high-heeled shoes. In many instances coming under our observation, such a change has been followed by most uncomfortable results.

DEDUCTIONS FROM OBSERVATIONS

Our conclusions from the experimental part of our paper are: that the center of gravity can be determined in the living erect individual; that this center of gravity is so located in relation to the supporting structures that the erect position is maintained by the tonicity of the posterior musculature; that forward displacement of the center of gravity leads to increased demand on the posterior musculature to maintain the erect position.

In the position induced by what we have designated as the good corset, the strain on the posterior musculature is lessened by displacing the center of gravity backward, and more especially by the fact that the shoulders are moved back at least as far as are the hips.

Though the bad corset also displaces the center of gravity backward, the relief to the posterior musculature which would be expected from this is neutralized in the position which they induce, by the fact that the pelvis is moved much further backward than the shoulders, thus inducing an inclined position of the back in which the weight of the trunk, considered by itself, is thrown so

far forward as to place undue strain on the posterior musculature of the lumbar and pelvic regions.

In the position induced by the wearing of high-heeled shoes, without any other modifying apparatus, the strain on the posterior musculature is relieved by motion of the center of gravity backward, through movement of the body backward as a whole, chiefly from the ankle-joint.

The study of two forms of modifying apparatus applied to the subject at the same time introduces so much complication of conditions that conclusions therefrom must be drawn up with great caution. When high-heeled shoes are observed in conjunction with either form of corset we conclude that the attitude characteristic of either form of corset is modified slightly toward the normal of the individual by the addition of high-heeled shoes, but the analysis of the effect so produced involves so complicated a mechanical study that we are not yet prepared to publish conclusions as to why this effect is produced.

II. CLINICAL SECTION

The clinical section of our paper is best introduced by the presentation of a few personal illustrative cases selected from many similar ones and reported in abstract for economy of space.

ILLUSTRATIVE CASES

CASE 1.—Patient, single, 53 years old, was sent to E. R. by a prominent orthopedic surgeon for backache and sense of weight in the abdomen which in spite of evident static faults had been uncorrected by his treatment, and which he was acute enough to believe must be traceable to some pelvic condition. On examination it was evident that her forward posture was due to an unconscious attempt to lessen pressure on a fibroid which nearly filled the true pelvis, and that the orthopedic apparatus had been ineffective in correcting the attitude or in relieving symptoms because it had been applied in the face of the determining cause, the fibroid. The patient made a prompt convalescence from a hysterectomy, but on rising from bed was extremely discouraged to find that the backache, which had led her to seek treatment, was, if anything, worse than before; but when she returned to the orthopedic surgeon who had originally treated her he found that the same apparatus which had before been ineffective now gave prompt relief, and after a few months she was able to drop it gradually. When last heard from, some time afterward, she was entirely well without treatment.

In this case orthopedic treatment was unsuccessful till the primary cause was removed. Hysterectomy alone might ultimately have relieved the backache without orthopedic treatment. Backache was, however, immediately and permanently cured by orthopedic treatment following the operation.

CASE 2.—Patient of E. R., married, aged 35, had undergone three major operations and prolonged local treatment without relief at the hands of three very prominent gynecologists, the chief symptoms being renal pain and sacral backache. The operations were nephrorrhaphy, anatomic success, with therapeutic failure, and two suspensions, both of them anatomic and therapeutic failures. Prolonged trials of pessaries had been made by two of the gynecologists, always ineffective, and always increasing pain and backache. Evident static faults, too complicated for the gynecologist to treat, were present and the patient was referred to the orthopedic surgeon of her choice after she had positively declined to allow replacement of the uterus and the insertion of a pessary on the ground of her previous experience. After considerable orthopedic treatment she was relieved of all her symptoms except sacral backache, which continued distressing. She then allowed E. R. to insert a pessary, which for the first time in her history she wore not only without pain but with immediate relief of the backache, and after wearing it for several months became able to maintain a forward position of the uterus without the pessary. She is still under orthopedic treatment but is relieved of her symptoms. Orthopedic treatment should have preceded an operation.

The names of the other medical men connected with these cases are omitted for obvious reasons.

CASE 3.—Patient, sent to E. R. by Dr. Chandler of Medford in January, 1908, 40 years old, married; no children; dysmenorrhea always; dyspareunia always; indigestion with intestinal gas three years; frequent frontal headache; occasional not very severe neuralgia in left sacrosciatic region, along the distribution of the left sciatic nerve and over the inner surface of the left thigh, always increased by walking and standing, but almost constant before and during catamenia. Pains and aches in all portions of the body. Patient did not seem in very bad condition, but was very self-centered, running from one specialist to another. On examination pelvic organs were normal. Diagnosis, orthopedic disability. Patient was told that she should consult an orthopedic surgeon but that her many specialists should be under the control of a neurologist whom she should see frequently and persistently; referred to Dr. J. J. Putnam with consent of Dr. Chandler with written opinion to this effect; referred by Dr. Putnam to R. W. L.

Examination by R. W. L. showed that the patient stood with a slight left lateral curve and in a general "slumped" attitude.

The lumbar region was flat, the dorsal region rounded and the knees were inclined to be held slightly flexed. She complained that she felt as if her back were not hollow enough; and to get relief she assumed a position with more lumbar curve in which the knees straightened. She showed marked tenderness over the left sacroiliac joint and felt some pain in the left leg. A radiograph showed that the sacroiliac joints were normal.

She was provided with properly fitted therapeutic corsets giving marked support in the lumbar region and which were tight around the pelvis, and was started on exercises. She was not markedly improved by this treatment at the end of a month.

Orthopedic treatment having failed to afford relief, Dr. Putnam put the patient under general rest-cure methods in a hospital. His observation there convincing him that the left-sided pain was genuine and persistent, and its catamenial exacerbation pronounced, he requested another examination from E. R. Examination without anesthesia was again negative, but under anesthesia the presence of a slightly enlarged, hard, non-tender left Fallopian tube was demonstrated, and a few days later the abdomen was opened. The left tube proved to be straight and patent, but with much thickened and indurated walls; the corresponding ovary slightly enlarged, sclerotic, and containing a very large number of small tense cysts scattered through it like a charge of birdshot. The left ovary and tube were removed, and abdomen closed. Normal convalescence. Patient declared that all abnormal sensations in left side had disappeared. On getting up there was, however, some left-sided sacroiliac backache, relieved by a therapeutic corset. Patient returned to Dr. Putnam's care. When last heard from, one year after operation, she considered herself well.

In this case the essential factor was at first missed and the case considered orthopedic. After longer observation the detection and cure of the abdominal lesion resulted in spontaneous relief of the apparently static symptoms.

CASE 4.—Patient of R. W. L., a healthy and well-developed young woman, a professional teacher of gymnastics, at the end of a very hard year developed severe sacral backache for which advice was sought. She was at the time wearing a small girdle. She was treated by corsets and one of Cook's back splints. The pain disappeared immediately and an observation was made showing that the center of gravity had been moved back $1\frac{1}{2}$ inches. This change was so great that a second observation was taken a week later for purposes of verification with identical results (Fig. 11).

The relief was permanent and the case was evidently one of pure back-strain induced by overexertion and therefore relieved by the change of balance and consequent relief to the posterior musculature without further treatment.

CASE 5.—Patient of R. W. L., a married woman, 34 years old, of rather less than average physique, had been fairly well

until her confinement a year and a half previous. Shortly after getting about she began to have pain in the back and in one leg, and standing was accompanied by great discomfort. She had lost flesh and was very nervous and apprehensive. Examination indicated that the backache was apparently static. She had been treated by osteopathy without success, and later the diagnosis of a relaxed sacroiliac joint had been made. For this a plaster-of-Paris jacket had been applied and worn without any relief of the pain. When she was seen she wore a steel back-brace and a neutral corset. An attempt was made to throw the center of gravity backward by means of a properly made corset reinforced by a light tempered steel back brace to throw her balance back; this gave immediate comfort, and gentle exercises were begun. In three weeks she was practically free from pain, had gained in flesh and was improving as to her nervous instability.

In this case of evident back-strain the use of the ordinary appliances to splint the back did not give relief, which was obtained by changing the body balance by corsets.

APPLICATION OF EXPERIMENTAL DEDUCTIONS TO CLINICAL CONDITIONS

It becomes evident from the most casual consideration that in this class of cases there exist two elements, the gynecologic and the orthopedic, and an analysis of the probable primary cause of the pain, therefore, becomes necessary.

That forward displacement of the center of gravity induces increased effort of the posterior musculature (back-strain) has been demonstrated in our experimental section. That such excessive or prolonged muscular effort may be translated into pain, spasm and irritability is not only more or less a matter of common information, but may be supported by quotation of certain well-known analogous instances. If the arm is held out horizontally, after two or three minutes the muscular effort is translated into an ache. The spasm and irritability of the ciliary muscle which is overstrained to accommodate for astigmatism is well known. The pain and dragging in pronated and flat feet is generally admitted to be due to muscular and ligamentous strain.

That back-strain sufficiently long continued, induced by an unduly forward position of the center of gravity may be translated into backache seems evident. The unduly forward position of the center of gravity which induces backache we believe to be usually caused by one of three factors:

1. Peculiarities in the form and proportions of the skeleton (not necessarily outside of normal limits) resulting in a type of figure with a center of gravity markedly far forward.

2. General muscular relaxation leading to a "slumped," relaxed attitude.

3. Tenderness of intra-abdominal or intrapelvic organs inducing the patient to assume a stooping or other strained position to relieve intra-abdominal or intrapelvic pressure.

The gynecologic cases described above belong in the latter class and, though it is evident that the field of intra-abdominal or other viscerai lesions which may cause such attitudes is wider than that covered by any merely gynecologic cases, yet they are presented as the most frequent representatives of a large class for the purposes of this paper.

It is further evident from the anatomy that in the case of the comparatively unprotected sacro-iliac joints even the painful spasms of the dorsal musculature may, and probably do, fail to prevent painful tension on the connective tissue (ligaments and fasciæ) placed there to regulate extremes of motion. Without denying the occasional existence of abnormally movable sacro-iliac articulations (mostly puerperal) we believe that undue tension on connective tissue from overstrain is sufficient to explain the symptomatology of most cases of apparent functional derangement of the sacro-iliac joints without invoking the possible existence of an abnormal mobility to explain it further.⁹

DIFFERENTIATION OF CASES AND TREATMENT

Our observations would be of little value to ourselves or to others were we not prepared to formulate certain conclusions governing the treatment of these cases. It is evident that a determination whether the original cause of the backache is primarily intra-abdominal or originally static is a necessary preliminary to intelligent or

9. It has been a matter of common observation that pain in the back, of the character described, may be induced by lateral inequalities of the skeleton producing lateral strain, e. g., a short leg; and during this series of observations we have been confronted by numerous instances of it. We feel sure that such lateral inequalities predispose to the unilateral (one-sided) localization of pain induced primarily by bilateral strain, but we have thought it necessary in this series of observations to limit ourselves to the one point of antero-posterior strain and have therefore recorded no observations on this issue.

effective treatment. In practice, in the comparatively limited field selected by us for discussion here, the cases would seem to fall schematically into three classes:

1. The gynecologic, of intrapelvic origin.
2. The orthopedic, of mechanical or static origin.
3. The borderland cases in which both elements are present, or in which the differentiation between the two is at first impossible.

The recognition of a borderland class is necessary on account of the frequency of its appearance in clinical work, but the line between this and the other classes is so indefinite that it can be described only by implication under the other headings.

1. Treatment of Cases of Intrapelvic Origin

Static backache is frequently a prominent symptom of the intrapelvic neoplasms. It is then due to an alteration of attitude caused either by an instinctive effort to lessen pathologic pressure within the pelvis, or by disturbance of balance from the actual weight of the larger growths. In these cases no improvement in the static condition can be expected until after the removal of the neoplasm, and here an immediate operative removal should be promptly followed by proper orthopedic treatment if necessary.

On the other hand, many of the ptoses are merely secondary results of static abnormalities. In these cases especially, gynecologists should be careful not to adopt treatment without first making a study of the static causes which so often have produced, or are perpetuating them, since some previously unmanageable retroverted uteri, prolapsed ovaries, etc., can be promptly relieved by minor intrapelvic treatment after the static faults which caused them have been corrected. Ptoses of the kidneys and other upper abdominal viscera are equally important and should be considered. Under these conditions, also, those cases which still demand major measures will more surely become symptomatic as well as anatomic successes, and many anatomic failures will be avoided.

In the inflammatory affections of the pelvic organs the instinctive efforts of the patient to protect the tender structures from the pressures and jars which are always incident to locomotion in the erect posture, lead usually to so persistent a maintenance of a constrained attitude

that the prominence of static backache in these cases is easily understood in the light of what has been said in our experimental section.

The relative value of static or intrapelvic treatment as an initial step in the management of these cases depends largely on the stage of acuteness at the time at which treatment is undertaken. It is generally conceded that during the presence of an acute symptomatology the inflammatory affections of the pelvic organs should have depletive and soothing rather than radical treatment. In the more acute cases the muscles of the back are almost invariably in a state of irritation and spasm, and no part of the initial palliative treatment is more important or more promptly grateful to the patient than rest in bed, support to the irritated muscles, hot packs, the local electric light bath, etc., for their relief. On the other hand, even in the chronic cases, too early attempts at mechanical correction of the faulty posture are apt to do harm rather than good so long as the pelvic tender-nesses are unrelieved, since if successful they again expose the tender organs to the pressures from which the faulty attitude has partially relieved them.

The complication of ptoses with inflammatory conditions demands evidently the weighing of relative indications in the individual case.

It is manifestly impossible to cover within the length of such a paper as this, even in outline, the whole field of gynecologic practice in its relation to static backache (even without the equally important lesions of general abdominal surgery), but we hope that what has been here said may serve to illustrate the principles involved.

The gynecologist may, of course, readily examine the backs of his patients and may with practice acquire some facility in the differential diagnosis of back-strains into those of primarily intra-abdominal or primarily static origin, but he should never forget that in the static cases the abnormality which is the original cause of the symptom may often be found in a distant part of the skeleton (e. g., the feet), and that its detection may require special knowledge.

Throughout the field of gynecologic practice the estimation of static conditions is of importance whenever backache is a symptom.

2. Treatment of Cases of Mechanical or Static Origin

The orthopedic surgeon will be wise to refer to the gynecologist for a preliminary examination and opinion by which to guide treatment, those cases in which the history, or the replies to the usual questions, are suggestive of uterine disease. This is especially important when the symptoms suggest the possible presence of inflammatory disease of the intrapelvic organs, since in these cases, as has been said above, alteration of attitude, such as would be indicated by the back-strain alone, may be distinctly harmful.

The accepted orthopedic treatment of back-strain as it exists to-day has been already spoken of in the beginning of the paper. It is a matter of common information that it is on the whole unsatisfactory. The treatment which from our point of view should be in theory the most satisfactory, and which in practice in our hands has proved the most successful, is as follows:

A defect of balance exists which in the end must be cured by remedying that defect of balance, a matter only to be brought about by substituting a correct for an incorrect attitude. Massage and gymnastic exercises to induce this correct attitude would seem to be the obvious method to follow. But practically this alone at the outset is generally unsatisfactory for the following reasons: One is dealing in most instances not with athletes with well-developed muscles, but with men, or more often women of less than average physique as a whole, whose back muscles in particular are overstrained, weak and irritated. These patients are recumbent not over ten out of the twenty-four hours as a rule, and for the rest of the time are generally sitting, standing, or walking. To begin by gymnastics on muscular development under these conditions is to exercise still further for perhaps half an hour daily, muscles already overused, and for the remaining fourteen hours of the twenty-four the irritation induced by the malposition goes on, for a correct position cannot at once be substituted for an incorrect position. It is a frequent experience to find the backache made immediately worse by such treatment, even when given by skilled persons. It is as if the oculist ordered his patients suffering from eye-strain due to astigmatism to use the eyes a little more each day to strengthen them before he corrected the visual error. The best results in

back-strain are to be obtained, not by attempting to strengthen irritated muscles at the outset by further use, but by temporarily putting them at rest by relieving the strain of the posterior musculature.

A properly fitting corset with a tight pelvic hold not only improves balance, but incidentally serves as a splint and support. The blacksmith who is to do heavy work with his arm puts a leather strap around his wrist to enable his muscles to work to better advantage. He gains thereby an extra annular ligament.

Proper corsets, then, accomplish three things in the relief of this condition :

1. They tend to correct vicious balance by carrying the center of gravity backward, thus relieving muscular strain.
2. They partially splint the lower back.
3. They furnish an artificial annular ligament to the glutei muscles.

High-heeled shoes are also to be recommended temporarily, when comfortable to the patient, because experimental observation has shown that they carry back the center of gravity, and clinical experience is generally confirmatory of their good effect.

If lateral deviation of the spine exists, it is to be improved by an extra lift on the shoe of the side to which the body leans.

In the more severe cases the active day should be a short one and recumbency for some hours during the day should be insisted on. It is only necessary to allude to the fact that the general condition of the patient must, of course, be attended to from the outset. After a week or two of such treatment, aimed at resting tired and irritated muscles, the patient is generally ready for the second stage of the treatment, muscular development as a means to the attainment of a permanently correct attitude. In irritable cases the exercises should be given at first in the recumbent position and later only in the erect position. The whole tendency of most medical gymnasts is to overdo both the massage and exercise at first. It must be remembered that the maximum muscular stimulation from massage is reached at the end of five minutes¹⁰ and that, after that, deterioration of muscular

10. McKenzie : Exercise in Education and Medicine, Philadelphia, 1909, p. 47.

strength follows. Increase of backache following the exercises is a sign of too active exercises or too long a period of them. They are best taken once a day, the length of the period being gradually increased.

It must be admitted that, irrational as it is, many cases of backache are relieved by the use of corsets and high-heeled shoes alone. In a larger number this is a most useful preliminary to further attempts at radical cure, and we must remember that we shall be really curing such patients only when we have found and removed the condition which caused the disturbance of balance inducing the back-strain.

CONCLUSIONS

We believe that static backache is essentially a mechanical disorder; that is, that it is the result of a loss of balance producing local strain on the tissues in the lumbosacral region and elsewhere in the posterior musculature. We further believe, and regard it as our most essential point, that whatever the local mechanism which produces the symptoms may be, such backache is in a large proportion of all cases not a disease in itself (as suggested by such terms as "hysterical spine," "relaxation of the sacro-iliac joints," etc.), but is a mere symptom-complex due to an abnormal attitude induced by peculiarities of the skeleton, lack of proper muscular balance, or abnormal conditions in the abdomen or elsewhere. We believe that in diagnosis the local condition should be regarded as primary only after every cause elsewhere has been excluded.

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